

STATE OF ALASKA

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**DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF WATER
WASTEWATER DISCHARGE PROGRAM**

January 20, 2006

ADEC Files: 475.45.007

Mike Lidgard
NPDES Unit Manager
USEPA
1200 Sixth Avenue
Seattle WA, 98101

RE: Draft 401 Certification of NPDES Permit AK-003865-2 for the Red Dog Mine

Dear Mr. Lidgard;

On November 7, 2005 EPA Region 10 requested a draft 401 certification for the renewal of NPDES Permit AK-003865-2, regulating wastewater discharges from the Red Dog Mine located in northwest Alaska. The enclosed draft contains provisions certifying a mixing zone, a Natural Condition Based Site Specific Criteria (NCBSSC) for cadmium, removal of a NCBSSC for zinc and other conditions to ensure compliance with 18 AAC 70.

The ADEC has enclosed the Draft Certificate of Reasonable Assurance to include in the public notice process. This draft 401 certification was created using the preliminary draft NPDES Permit AK-003865-2, offered for review by EPA on 11/7/05. I look forward to working with your staff on the renewal of this permit.

If you have any questions regarding this draft certification please contact me at 907-451-2142 or at luke_boles@dec.state.ak.us.

Sincerely,

SIGNATURE ON FILE

Luke Boles
Environmental Engineering Associate
Wastewater Discharge Program

Enclosures: Draft Certificate of Reasonable Assurance for NPDES Permit AK-003865-2

CC:

Cindi Godsey, EPA, Anchorage
Sharmon Stambaugh, ADEC, Anchorage
Mark Thompson, TCAK
Cam Leonard, ADOL, Fairbanks
Rose Barr, NANA

Al Ott, ADNR/OHMP, Fairbanks
Nancy Sonafrank, ADEC, Fairbanks
Tom Crafford, ADNR/OPMP, Anchorage
Larry Hartig
Jim Kulas, TCAK

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DRAFT CERTIFICATE OF REASONABLE ASSURANCE

A Certificate of Reasonable Assurance, as required by Section 401 of the Clean Water Act, has been requested by TeckCominco Alaska for NPDES Permit AK-003865-2 for the discharge of treated non-domestic wastewater, treated domestic wastewater and stormwater from the Red Dog Mine.

Public Notice of the application for this certification will be made in accordance with 18 AAC 15.140.

Water Quality Certification is required because the activity will be authorized by an Environmental Protection Agency permit identified as NPDES Permit AK-003865-2 and discharges will result from the activity.

This NPDES permit certification covers wastewater disposal from the following discharges:

1. Outfall 001 – Discharge of treated mine drainage and excess precipitation to the Middle Fork of Red Dog Creek. Outfall 001 is located at Latitude 68° 04'17" N, Longitude 162° 52' 05" W.
2. Outfall 002 – Discharge of treated domestic wastewater to the tundra. Outfall 002 is located at Latitude 68° 01' 45" N, Longitude 162° 54' 56" W.
3. Discharge of snowmelt and rainfall runoff from the site as indicated in the Stormwater Pollution Prevention Plan.

Appendix A is hereby incorporated by reference as part of this Certification. Appendix A provides the Department's rationale for the establishment of a Natural Condition Based Site Specific Criterion (NCBSSC) as the applicable water quality criterion for cadmium in Main Stem Red Dog Creek and in Ikalukrok Creek. This action is taken under 18 AAC 70.235(b). The Department has reviewed the applicant's request for a NCBSSC and finds the prevailing highest quality natural condition cadmium concentration in Ikalukrok Creek to be a total concentration of 2 µg/L in Ikalukrok Creek. See Appendix A of this Certificate for a discussion on the cadmium NCBSSC.

The Department has reviewed TeckCominco Alaska's request to rescind the NCBSSC for zinc applied to Main Stem Red Dog Creek that was approved in the 401 certification issued for the 1998 NPDES permit. At the time of the certification the zinc NCBSSC was less stringent than the applicable zinc water quality criterion (WQC) at 18 AAC 70.020(b). Since the approval of the NCBSSC for zinc in the 1998 NPDES permit certification, the WQC for zinc has become less stringent, resulting in the NCBSSC being more stringent than the currently applicable WQC for zinc listed in 18 AAC 70.020(b)(11). The Department finds that the NCBSSC for zinc in the Main Stem Red

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Dog Creek is not required to protect existing uses of the waterbody and removal of the zinc NCBSSC is hereby approved. The applicable WQC for zinc in the Main Stem Red Dog Creek shall be determined as required in 18 AAC 70.020(b) and the *Alaska Water Quality Criteria Manual*. These are the criteria the effluent limits in this NPDES permit should be based on. This finding has been reviewed with respect to the Antidegradation policy, specifically 18 AAC 70.015(a)(2), and found to be consistent with this policy.

The Department has reviewed the application with respect to the antidegradation policy of the Alaska Water Quality Standards and finds the reduction in water quality to be in compliance with the requirements of 18 AAC 70.015, provided that the terms and conditions of this certification are made part of the final NPDES Permit.

The Department has reviewed the discharges with respect to the Alaska Coastal Management Program (ACMP), as required under 11 AAC 110, and finds that there are no major modifications proposed from the previous ACMP consistency finding. This facility was previously found to be consistent with the ACMP during the previous NPDES Permit renewal. Therefore, pursuant to 11 AAC 110.820(k)(3) and (4), consistency review is not required for this permit reissuance.

Having reviewed the preliminary draft permit, the Alaska Department of Environmental Conservation certifies that there is reasonable assurance that the proposed activity, as well as any discharge that may result, is in compliance with the requirements of Section 401 of the Clean Water Act, which includes the Alaska Water Quality Standards (18 AAC 70). Through this certification, in accordance with 18 AAC 15.120 ADOPTION OF NPDES PERMITS, the final NPDES permit will constitute the permit required under AS 46.03.100 Waste Disposal Permit, provided that the terms and conditions of the final certification are made part of the final NPDES Permit. The department is specifying the following permit terms and conditions under authority of AS 46.03.110(d):

1. The ADEC authorizes the following mixing zones in this certification (NPDES Preliminary Draft Permit parts I.A.1 and I.A.8a):

A mixing zone in Main Stem Red Dog Creek of 1.5:1 (2.5x) dilution extending from the confluence of the Middle Fork Red Dog Creek with the North Fork Red Dog Creek to Station 151. The Main Stem Red Dog Creek mixing zone is approximately 1,930 feet in length. The mixing zone is granted for the following parameters: total dissolved solids (TDS), ammonia and WAD cyanide.

A mixing zone in Ikalukrok Creek of 1:1 (2x) dilution extending from the confluence of Main Stem Red Dog Creek and Ikalukrok Creek to Station 150. The mixing zone is approximately 3,420 feet in length. The Ikalukrok Creek mixing zone is granted for TDS.

Rationale: In accordance with State Regulations 18 AAC 70.240, the Department has authority to designate mixing zones in permits or certifications. The authorized mixing zones will ensure that the water quality standards are met at all points outside of the mixing zones.

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The Department considered all aspects required in 18 AAC 70.015 (Antidegradation) and 18 AAC 70.240-270 (Mixing Zones) including, but not limited to, the potential risk to aquatic life based on existing monitoring data of effluent, and, Ikalukrok Creek and Main Stem Red Dog Creek water quality.

The Department finds that the sizes of the mixing zones authorized for discharge in this certification are appropriate and provide reasonable assurance that existing uses of Ikalukrok Creek and Main Stem Red Dog Creek outside of the mixing zones are maintained and fully protected.

2. The pH effluent limits for Outfall 001 are 6.0 to 10.5 pH units (NPDES Preliminary Draft Permit part I.A.2)

Rationale: *The Department proposes to certify the same pH effluent limits as contained in the current NPDES Permit.*

The most stringent Alaska Water Quality Standard regulation for pH protects Growth and Propagation of Fish, Shellfish, other Aquatic Life and Wildlife. It requires that pH "not be less than 6.5 or greater than 9.0 and not vary more than 0.5 pH unit from natural conditions."

An optimum pH, approximately 9.5 to 10.5 pH units, will precipitate metals from the effluent before it is discharged. Baseline pH at Station 30 (just above the present effluent discharge location) ranged from 5.8 to 6.7. Data collected at the discharge and in the receiving waters since mine operations began, indicate that pH stabilizes shortly after discharge into Red Dog Creek. pH is above 6.5 at Station 20 and is approximately 7 pH units at the mouth of Red Dog Creek; i.e., the mixing of basic discharge waters with acidic creek waters results in a slightly basic to neutral pH where fish occur. No mixing zone for pH is needed with the NPDES effluent limit range of 6.0 to 10.5 pH units.

3. Preliminary Draft Permit part I.A.8.b – the following language likely will not be necessary in the final Permit: "Prior to beginning discharge, the permittee shall consult with EPA, Alaska Department of Natural Resources, Office of Habitat Management and Permitting (OHMP), and Alaska Department of Environmental Conservation (ADEC), and the permittee must receive written approval from EPA."

Rationale: *The regulation package adopting a Total Dissolved Solids Site Specific Criterion (SSC) under 18 AAC 70.235(c) was adopted by the State of Alaska and is expected to be approved by EPA prior to final Permit issuance. The proposed TDS SSC would allow TDS concentrations up to 1500 mg/L in Main Stem Red Dog Creek without timing restrictions. The Department finds that the notification and subsequent approval process will no longer be necessary to ensure that discharge will not affect aquatic life uses of the waterbody if the TDS SSC regulations are adopted as proposed.*

4. Preliminary Draft Permit part I.A.8.c shall be updated as follows:

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After the commencement of discharge, the permittee shall limit the TDS load discharged from Outfall 001 so as to maintain in-stream TDS concentrations at or below:

- (1) 1500 mg/L at the edge of the mixing zone in Main Stem Red Dog Creek,
- (2) 1000 mg/L at the edge of the mixing zone in Ikalukrok Creek throughout the discharge season, and
- (3) 500 mg/L from July 25th through the end of the discharge season at Station 160.

Rationale: The regulation package adopting a Total Dissolved Solids Site Specific Criterion under 18 AAC 70.235(c) was adopted by the State of Alaska and is expected to be approved by EPA prior to final Permit issuance. The proposed TDS SSC would allow TDS concentrations up to 1500 mg/L in Main Stem Red Dog Creek without timing restrictions. The Department finds that the in-stream limits are required to ensure that existing uses are protected.

In 1999, the Department changed the water quality criterion under 18 AAC 70.020(b)(Note 12) for inorganic dissolved solids, regulated as TDS, to the following:

*Total Dissolved Solids (TDS) in concentrations up to 1000 mg/L in Ikalukrok Creek are in effect from the confluence of Ikalukrok Creek with Main Stem Red Dog Creek down to the Wulik River, **except** during chum salmon and/or Dolly Varden spawning in Ikalukrok Creek, when the aquatic life criterion of 500 mg/L will apply at Station 160.*

This criterion is in effect in the Ikalukrok Creek for the areas listed above.

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

5. The Department believes that Preliminary Draft Permit parts I.A.8.d and I.A.8.e will not be applicable and could be deleted in the final Permit.

Rationale: The regulation package adopting a Total Dissolved Solids Site Specific Criterion under 18 AAC 70.235(c) was adopted by the State of Alaska and is expected to be approved by EPA prior to final Permit issuance. The proposed TDS SSC would allow TDS concentrations up to 1500 mg/L in Main Stem Red Dog Creek without timing

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restrictions. The Department finds that the in-stream limits are required to ensure that existing uses are protected.

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the Department shall include a statement of the extent to which each condition of the draft permit may be made less stringent without violating the requirements of State law. These statements are included above where it states that a change to the Preliminary Draft Permit "could" be made.

6. Preliminary Draft Permit part I.A.8.f(1) shall reference Station 151 as the downstream edge of the mixing zone in Main Stem Red Dog Creek. Station 150 shall be referenced as the downstream edge of the mixing zone in Ikalukrok Creek. Monitoring at Station 151 for TDS shall occur weekly. Monitoring for TDS at Station 150 shall occur monthly.

Preliminary Draft Permit part I.A.8.f(2) could be deleted.

Preliminary Draft Permit part I.A.8.f(3) shall read: "Conductivity and temperature shall be monitored concurrently with TDS at Stations 150, 151 and 160".

Preliminary Draft Permit part I.A.8.g, I.A.8.h, I.A.8.i and Preliminary Draft Permit part I.A.8.k shall replace Station 10 with Station 151.

Rationale: *In accordance with State Regulations 18 AAC 70.245, the Department has authority to ensure that existing uses of the waterbody outside the mixing zone are maintained and fully protected. The specified monitoring will provide evidence to the Department that the effluent treatment and mixing zone size are adequate to protect all existing uses in the receiving water. The Preliminary Draft Permit required more monitoring than is required to reasonably demonstrate compliance with the Water Quality Standards (18 AAC 70).*

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the Department shall include a statement of the extent to which each condition of the draft permit may be made less stringent without violating the requirements of State law. These statements are

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included above where it states that a change to the Preliminary Draft Permit "could" be made.

7. Preliminary Draft Permit part I.D - Ambient Monitoring Requirements – may be updated as follows:

I.D.1 – delete reference to Stations 2, 9, 20 and Tributaries. Replace Station 73 with Station 160. Replace Station 10 with 151.

I.D.2 – delete reference to Station 2 and replace with Station 151.

I.D.6 – Ambient monitoring results from Stations 151 and 160 shall be submitted to EPA, ADEC and OHMP with the monthly DMR. Other required ambient monitoring results could be submitted in the Annual Water Monitoring Summary Report required in section II.J (see condition #10 of this certification).

I.D.7 – Table 5 – Ambient Monitoring Requirements: reference to Stations 2, 9, 20 and Tributaries could be deleted. Station 73 shall be replaced with Station 160. Station 10 shall be replaced with 151.

I.D.8 – References to streamflow measurements at Stations 2, 8, 9, 10, 12 and 140 could be deleted. Streamflow shall be monitored at Stations 151 and 160 as required to perform the calculations in I.A.8.i. Streamflow results from Stations 151 and 160 shall be submitted in the Annual Water Monitoring Summary Report required in section II.J (see condition #10 of this certification).

Rationale: In accordance with State Regulations 18 AAC 70.245, the Department has authority to ensure that existing uses of the waterbody outside the mixing zone are maintained and fully protected. The specified monitoring will provide evidence to the Department that the effluent treatment and mixing zone size are adequate to protect all existing uses in the receiving water. The Preliminary Draft Permit required more monitoring than is required to reasonably demonstrate compliance with the Water Quality Standards (18 AAC 70). Some of the Ambient Monitoring Program contained in the current NPDES permit and not required by this certification will be required in the Monitoring Plan associated with the Waste Management Permit issued by ADEC for the management of tailings, waste rock and other wastes at the facility.

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the Department shall include a statement of the extent to which each condition of the draft permit may be made less stringent without violating the requirements of State law. These statements are

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included above where it states that a change to the Preliminary Draft Permit "could" be made.

8. Preliminary Draft Permit part I.F – Bioassessment Program Requirements shall be updated as follows:

I.F.1 could be deleted as it is duplicative of I.F.2.

I.F.2 shall be updated as follows:

Bioassessment conditions required by the Alaska Department of Environmental Conservation Certificate of Reasonable Assurance: Within 60 days of the effective date of the permit, the permittee shall submit for review and approval to ADEC and OHMP, an updated version of the Biomonitoring Plan - ADF&G Methods for Aquatic Life Monitoring to Satisfy requirements under 1998 NPDES Permit - submitted by Cominco Alaska Inc, 1998, which was designed to detect possible aquatic community changes related to the mine effluent as follows:

Upon approval, the permittee shall implement the plan annually.

I.F.2 –Table 6 could be updated as follows:

TABLE 6 – Bioassessment Sites	
Sample Site	Factors Measured
North Fork Red Dog Creek	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Main Stem Red Dog Creek	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Ikalukrok Creek	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use

Rationale: In accordance with State Regulations 18 AAC 70.245, the Department has authority to ensure that existing uses of the waterbody outside the mixing zone are maintained and fully protected. The specified monitoring will provide evidence to the Department that the effluent treatment and mixing zone size are adequate to protect all existing uses in the receiving water. The Preliminary Draft Permit required more monitoring than is required to reasonably demonstrate compliance with the Water Quality Standards (18 AAC 70). The remaining biomonitoring program contained in the current NPDES permit will be required in the Monitoring Plan associated with the Waste

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Management Permit issued by ADEC for the management of tailings, waste rock and other wastes at the facility.

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the Department shall include a statement of the extent to which each condition of the draft permit may be made less stringent without violating the requirements of State law. These statements are included above where it states that a change to the Preliminary Draft Permit "could" be made.

9. Preliminary Draft Permit parts I.A.1, I.D.7 and I.G – Whole Effluent Toxicity (WET)

This certification does not require effluent limits for WET as contained in I.A.1 – Table 1 and these effluent limits could be removed. Monthly WET monitoring of the effluent is required by this certification. WET monitoring of the effluent shall be conducted on the fathead minnow, *Pimephales promelas* (larval survival and growth test) and on the water flea, *Ceriodaphnia dubia* (survival and reproduction test).

WET monitoring at Stations 9 and 12 is not required in this certification and could be removed in the Final Permit.

Rationale: The Department believes that there is no reasonable potential for the effluent to exceed the pre-mining natural toxicity of Red Dog Creek. The methodology used in the 1998 NPDES Permit to estimate natural toxicity in Red Dog Creek by assigning a WET value contained numerous assumptions and uncertainties that cannot be confirmed. While the pre-mining toxicity cannot be quantitatively confirmed, the Department believes that the effluent is less toxic than the natural condition of Red Dog Creek. Comparisons of water quality data for metals concentrations indicate that the discharge is less toxic than the natural condition in Red Dog Creek. The following paragraph is from this Department's 401 certification of the NPDES Permit that is currently in effect, which was issued in 1998:

"Finally, given all the uncertainties that surround not only our estimate of the natural toxicity in the Red Dog system, but also in the precision of WET testing itself, it makes sense to take advantage of the comprehensive biological monitoring that is occurring in those waters. Ultimately, direct observation and sampling of aquatic life in the system is more meaningful than laboratory WET testing. For that reason, we are strengthening the monitoring program that is already occurring. The

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new monitoring plan is included on p.2 of the revised draft certification. It may be that when this draft permit is reissued in five years, we will have enough confidence in our biological monitoring that we can dispense with WET limits altogether."

Additionally, the 1998 401 certification discussed the applicability, at the point of discharge, of the regulations found at 18 AAC 70.020(b)(11)(C) and 18 AAC 70.030 regulating discharge of toxicity. The 1998 401 certification stated that since aquatic life is not a designated use at the point of discharge these regulations do not apply. Further, the Department's 1998 certification discussed that the effluent from the Red Dog Mine has less toxicity than the receiving water, which is clearly not contemplated under 18 AAC 70.020(b)(11)(C) and 18 AAC 70.030. The Department's position remains as stated in the 1998 401 certification: that 18 AAC 70.020(b)(11)(C) and 18 AAC 70.030 do not apply at the point of discharge and that the biomonitoring program is ultimately more meaningful than WET testing.

Aquatic biomonitoring at the Red Dog Mine began in 1990 and has continued annually since then. In 1999, an expanded biological monitoring program was initiated as a requirement of the NPDES Permit and the ADEC certification. The biological monitoring program (water quality, periphyton, aquatic invertebrates, and fish) has continued each year. Annual technical reports summarizing biomonitoring have been reviewed, and while changes have been observed, there have been no observed negative effects to the ecosystems of Red Dog and Ikalukrok Creeks resulting from the effluent or mine related activities affecting Red Dog Creek. The Department is requiring that the biomonitoring program in the 401 certification be at stations necessary to ensure that potential effects from the discharge are monitored (see condition # 8 of this certification). The remaining biomonitoring program will be contained in the Monitoring Plan associated with the Waste Management Permit issued by ADEC for the management of tailings, waste rock and other wastes at the facility.

Although ADEC finds there is not a reasonable potential for the toxicity of the effluent to exceed the toxicity of the receiving water in its natural condition, to provide additional assurance that the existing uses in Red Dog Creek are being protected, ADEC is continuing the comprehensive biomonitoring program. ADEC is also requiring monthly WET testing of the effluent to serve as an indicator of potential changes in the discharge over time, changes which might take longer to detect using field observations.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the Department shall include a statement of the extent to which each condition of the draft permit may be made less stringent without violating the requirements of State law. These statements are included above where it states that a change to the Preliminary Draft Permit "could" be made.

10. The following Permit part, II.J - Annual Water Monitoring Summary Report, shall be added to the Permit:

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All monitoring results for a year must be included in an Annual Water Monitoring Summary Report and submitted by March 1 of the following year. The report must include a presentation of the analytical results and an evaluation of the results of monitoring required in Permit parts I.A, I.B, I.C, I.D, I.E, I.F and I.G. The evaluation must include an electronic spreadsheet containing monitoring data from the previous five years, a graphical presentation of the data at each monitoring station, a comparison of upstream and downstream monitoring results (to show any differences) and a comparison of monitoring results for each station over time (to show any trends). The Annual Water Monitoring Summary Report may reference the monthly reports for QA/QC information.

All monitoring results for a calendar year shall be reported in the Annual Water Monitoring Summary Report. At a minimum, the report must include the following:

- a. Dates of sample collection and analyses.
- b. Results of sample analysis.
- c. Relevant quality assurance/quality control (QA/QC) information.

Rationale: In accordance with State Regulations 18 AAC 70.245, the Department has authority to ensure that existing uses of the waterbody outside the mixing zone are maintained and fully protected. The specified monitoring will provide evidence to the Department that the effluent treatment and mixing zone size are adequate to protect all existing uses in the receiving water.

In accordance with State Regulations 18 AAC 15.090, the Department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

January 20, 2006

Date

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Gretchen Keiser
Program Manager
Wastewater Discharge Program

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APPENDIX A CADMIUM NATURAL CONDITION BASED SITE SPECIFIC CRITERION

Introduction

The Red Dog Mine is a lead/zinc mine located near the Arctic Circle. It is in the foothills of the De Long Mountains of northwest Alaska, approximately 100 miles northwest of Kotzebue and 52 miles from the Chukchi Sea coastline. It is a remotely located facility accessible only by ship or chartered airplane. There are no other industrial facilities in the area. The nearest village is Kivalina, population 300, located at the mouth of the Wulik River on a barrier beach on the Chukchi Sea.

The Red Dog ore deposit is in the form of metal (zinc, lead) sulfides in a Mississippian shale formation lying on and within a ridge between the Middle Fork Red Dog Creek and South Fork Red Dog Creek (see Attachments A-1 and A-2).

The mill site lies to the west of the ore deposit and above the tailings impoundment. The tailings impoundment is formed by a dam across the South Fork of Red Dog Creek. Baseline data collection occurred from 1981 through 1987. Removal of overburden from the ore deposit and construction of the tailings dam began in 1987. The first ore was delivered to the mill late in 1989, and the first concentrates were produced in December 1989.

Request for Site Specific Criterion

TeckCominco Alaska, Inc., the operator of the Red Dog Mine has requested that the Department of Environmental Conservation (ADEC) grant relief from the existing chronic aquatic life criterion for cadmium. They have requested a site-specific criterion based on the natural condition of the Main Stem Red Dog Creek from the confluence of North Fork Red Dog Creek to the confluence with Ikalukrok Creek; and in Ikalukrok Creek from its confluence with Main Stem Red Dog Creek to its confluence with Dudd Creek. These are the stream segments where it has been documented that the natural background cadmium levels exceed the Alaska chronic aquatic life criterion.

Regulatory Requirements

Federal regulations at 40 CFR 122.44 (d)(1)(iv) and (v) require an effluent limit for cadmium to be incorporated into a National Pollutant Discharge Elimination System (NPDES) permit when a discharge has the reasonable potential to cause or contribute to an in-stream excursion above a numeric or narrative criterion within an applicable state water quality standard.

Alaska water quality standards (WQS) regulations allow for the development of a site-specific criterion (SSC), see 18 AAC 70.235. More specifically, Alaska WQS contain a provision that allows the development of a SSC based on the natural condition of a water

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body. Under 18 AAC 70.235(b), "If the department finds that a natural condition of a water body has been demonstrated to be of lower quality than a water quality criterion set out in 18 AAC 70.020(b), the natural condition constitutes the applicable water quality criterion." Natural condition is defined, by the State, as any physical, chemical, biological, or radiological condition existing in a waterbody before any human-caused influence on, discharge to, or addition of material to, the waterbody [18 AAC 70.990(41)].

Applicable Water Quality Standards

Alaska's WQS are composed of use classifications and numeric and/or narrative water quality criteria. The first part of a Alaska's water quality standard is a classification system for water bodies based on the expected designated uses of those water bodies. The second part of a state's water quality standards is the water quality criteria deemed necessary to support the designated use classification of each water body. These criteria may be numeric or narrative.

I. Designated Uses

The State of Alaska water quality standards protect Main Stem Red Dog Creek, and Ikalukrok Creek below Red Dog Creek for the following designated uses:

- Industrial water supply;
- contact recreation, wading only;
- secondary recreation, and;
- growth and propagation of fish, shellfish, other aquatic life, and wildlife

As specified in 18 AAC 70.230(e)(8) and 18 AAC 70.230(e)(18) the following designated uses have been removed from Main Stem Red Dog Creek, and Ikalukrok Creek below Red Dog Creek:

- Drinking, culinary, and food processing water supply;
- agriculture water supply;
- aquaculture water supply, and;
- contact recreation, with the exception of wading

II. Criteria to Protect the Designated Uses

The criterion for industrial water supply is a narrative criterion that states that substances that pose hazards to worker contact may not be present. A review of the available literature indicates that criteria to protect workers have not been developed for cadmium (EPA Quality Criteria for Water, 1976).

The Table at 18 AAC 70.230(e)(18) states that the Main Stem Red Dog Creek is protected for contact recreation, wading only. However the definition section at 18 AAC 70.990(16) defines contact recreation to "not include wading". Due to the cold

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temperature and the natural condition exceeding the Drinking Water MCL for Cadmium, the direct and intimate contact recreation uses including swimming, diving, and water skiing are not protected, but wading with rubber boots for activities including water quality sampling is protected. The applicable cadmium criterion for contact recreation (wading only) and secondary recreation is a narrative criterion: "Concentrations of substances that pose hazards to incidental human contact may not be present".

The most stringent cadmium criteria for the Main Stem Red Dog Creek, and Ikalukrok Creek below Red Dog Creek are associated with the aquatic life use designation. There are two types of criteria for the protection of aquatic life: acute and chronic. Acute criteria protect against short term deleterious effects to aquatic life, and chronic criteria protect against long term deleterious effects to aquatic life. For Alaska, the acute criterion for cadmium is a hardness-based criterion that is found in 18 AAC 70.020(b)(11)(C). The acute criterion for cadmium is 5.09 µg/L dissolved concentration, based on the site's ambient hardness of 260 mg/L. The chronic criterion for cadmium is 0.48 µg/L dissolved concentration, based on the site's ambient hardness of 260 mg/L.

Natural Condition Determination

As part of the development of the Use Attainability Analysis (UAA) for reclassification of waterbodies in the vicinity of Red Dog mine, EPA requested information regarding any human activities (land disturbance from road building, camp construction, or exploration) that could have contributed to the water quality exceedences that were found in the pre-mining water quality data base. The UAA concludes that there were no human activities in the vicinity of the mine that could have caused significant changes in the water quality until overburden was removed in the spring of 1987. In accordance with 18 AAC 70.990(41) there were no anthropogenic sources of pollution and the baseline water quality (1981 - 1987) is representative of natural conditions.

Demonstration that the Natural Condition is of Lower Quality than the Applicable Criteria

The waters of Red Dog Creek are atypical of most undeveloped Arctic streams because of the high concentrations of cadmium, lead, and zinc that enter the Middle Fork of Red Dog Creek as it flows through a highly mineralized ore body. The unique character of the Red Dog mineralization and its interaction with ground and surface waters was recognized in scientific studies of the area in the late 1970's and early 1980's (e.g. Ward and Olson 1980). Natural levels of metals were known to be unusually high, and fish kills (in Main Stem Red Dog Creek) were documented. From 1981 through 1984, Cominco Alaska funded a series of baseline studies to document water quality and biological conditions in Red Dog Creek, Ikalukrok Creek, and the Wulik River (Houghton 1983, Petersen and Nichols 1983). In 1982, ADEC funded a detailed toxicological, biophysical, and chemical assessment of Red Dog Creek (E.V.S. Consultants, Ltd. 1983). In the 1984 Final Environmental Impact Statement (EIS), these studies formed the basis for addressing aquatic and water quality impacts associated with the development of the Red Dog Mine Project.

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Water in the Middle Fork Red Dog Creek, beginning adjacent to the highly mineralized orebody, was naturally degraded and remained in this condition downstream to the confluence with the South Fork (L. A. Peterson & Associates, Inc. 1983, Water Quality of Red Dog Creek, Alaska, 1983, in Supplement to Environmental Baseline Studies, Red Dog Project. Dames & Moore report to Cominco Alaska, Inc.). The Middle Fork flowed directly over heavily mineralized rock, and the creek received surface and groundwater draining from the orebody, which contained high metal and sulfide concentrations (U.S. Environmental Protection Agency and U.S. Department of the Interior. 1984. Final EIS, Red Dog Mine Project, Northwest Alaska). Recovery of water quality began at the confluence of the Middle Fork and the South Fork, but was not particularly significant until flow from the North Fork diluted the Middle Fork to form the Main Stem. Pre-disturbance ambient samples collected at station 10 confirm that Main Stem Red Dog Creek had naturally occurring cadmium concentrations above the current water quality criteria. Pre-disturbance ambient samples collected at station 8 confirm that Ikalukrok Creek also had naturally occurring cadmium concentrations above the current water quality criteria.

The dissolved data collected prior to the development of the mine site is summarized in Attachment A-3. In Main Stem Red Dog Creek (station 10) dissolved concentration water quality data were collected from July 23, 1982 through September 3, 1983. At station 10 the cadmium data ranged from a dissolved concentration of 2 µg/L to 41 µg/L. In Ikalukrok Creek (station 8) dissolved concentration water quality data were collected from July 18, 1981 through June 15, 1983. At station 8 the cadmium data ranged from a dissolved concentration of 2 µg/L to 34 µg/L. The 5th percentile of the dissolved data at station 10 is 12.5 µg/L. The 5th percentile of the dissolved data at station 8 is 3.5 µg/L. All of the data collected in these stream segments demonstrate that the water is of lower quality than the cadmium chronic aquatic life criterion of 0.48 µg/L.

The total data collected prior to the development of the mine site is summarized in Attachment A-4. In Main Stem Red Dog Creek (station 10) total concentration water quality data were collected from May 30, 1982 through September 13, 1983. At station 10 the cadmium data ranged from a total concentration of 2 µg/L to 44 µg/L. In Ikalukrok Creek (station 8) total concentration water quality data were collected from May 30, 1982 through August 17, 1987. At station 8 the cadmium data ranged from a total concentration of 1 µg/L to 38 µg/L. The 5th percentile of the total data at station 10 is 9 µg/L. The 5th percentile of the total data at station 8 is 2 µg/L. All of the data collected in these stream segments also demonstrate that the water is of lower quality than the cadmium chronic aquatic life criterion of 0.48 µg/L.

Natural Condition Based Site-Specific Criteria Development

The natural levels of cadmium in the ambient waters vary in two ways. First, the cadmium levels decrease as the distance downstream from the orebody increases. The cadmium levels are highest in Middle Fork immediately after passing through the orebody, and lowest in the Ikalukrok Creek below the Main Stem. Ikalukrok Creek

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below Main Stem represents the highest quality water of those stream segments affected by the orebody. To ensure that cadmium levels in Ikalukrok Creek do not increase above pre-mining levels, this stream segment (station 8) was used to develop the site-specific criterion for Ikalukrok Creek..

Second, the cadmium levels vary over time. The Department's regulation states, in part, that if a natural condition varies with time, the natural condition will be determined to be the prevailing highest quality natural condition measured during an annual, seasonal, or shorter time period. Pre-mining water quality data exist from 1981 to 1987. Water quality monitoring was conducted in 1981 and 1982 in order to establish the pre-mining baseline water quality for use in the EIS that was being prepared before mine development. Additional pre-mining water quality data were gathered in 1983, 1986, and 1987. The 1981 - 1987 pre-mining cadmium concentration data from stations 8 and 10 were used to develop the site specific criterion to ensure that variation in the levels of cadmium from year to year is represented. Some pre-mining data were not used because dissolved cadmium concentrations were not analyzed in those samples. The dissolved cadmium concentration was used to calculate the criteria as required in the Alaska Water Quality Standards (18 AAC 70)¹, however the total cadmium concentration at station 8 was used to calculate the criteria required by EPA for use in setting effluent limits.

To represent the highest quality water, the 5th percentiles of the pre-mining data sets from stations 8 and 10 have been used. The 5th percentiles of the data sets are dissolved cadmium concentrations 3.5 µg/L and 12.5² µg/L for stations 8 and 10, respectively, and 2 µg/L and 9 µg/L for stations 8 and 10, respectively. This means that 5 times out of 100 the natural cadmium concentrations were equal to or lower than these numbers (higher water quality) in the respective water bodies. Another way of stating this is that 95 percent of the natural cadmium concentrations were greater than these numbers (lower water quality) in the respective water bodies. Using the Ikalukrok Creek site specific criterion (2 µg/L) means the mine effluent will be required to reflect the highest quality water that naturally occurred in Ikalukrok Creek. Therefore, 95 percent of the time the total cadmium concentration in the mine's effluent will be lower than the total concentration of cadmium in the receiving water. The 5th percentile approach using station 8 data to develop the NCBSSC is a very conservative approach.

The Department believes that the Main Stem Red Dog Creek site specific criterion (12.5 µg/L) is the appropriate criterion to use in calculating effluent limits for the Red Dog Mine facility, however using the Ikalukrok Creek site specific criterion (2 µg/L) is more conservative.

Designated and Existing Use Protection

¹ Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances, May 15, 2003, Table III; as referenced in 18 AAC 70.020(b)(11)(C).

² For sample results that were reported as less than the MDL (generally 25 µg/L); ½ the MDL (12.5 µg/L) was substituted in the dataset for purposes of calculating the 5th percentile. Some results were reported below 25 µg/L; in this case the value reported was used when calculating the 5th percentile.

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Federal WQS regulations require that a State specify the water uses to be achieved and protected and there are two broad use categories, designated uses and existing uses. A designated use is a use specified in State WQS regulations for a water body whether or not it is being attained. The designated uses for the waterbodies at the site are listed on page 2 of this appendix: industrial water supply; contact recreation (wading only); secondary recreation; and growth and propagation of fish, shellfish, other aquatic life and wildlife. An existing use is, by definition [18 AAC 70.990(24)], "the uses actually attained in a waterbody on or after November 28, 1975."

The Antidegradation Policy requires that existing uses must be protected by a SSC. The Antidegradation Policy states, in part, that "existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected" (18 AAC 70.015(a)(1)).

The following discussion examines whether each designated and existing use could be protected by a site-specific cadmium criteria of 3.5 µg/L and 12.5 µg/L in Ikalukrok Creek and Main Stem Red Dog Creek, respectively. The analysis of designated uses looks at the current and future condition of the waterbodies. For example, is aquatic life currently found at the site or is growth and propagation of aquatic life a future goal for the waterbodies at the site. The time frame for the analysis of an existing use extends from November 28, 1975 to the current time.

I. Industrial, Contact Recreation (wading only), and Secondary Recreation Uses

The Red Dog and Ikalukrok Creeks Use Attainability Analysis (UAA) (December 1996) evaluated whether the industrial, contact recreation, and secondary recreation designated uses were existing water uses and whether the designated uses should be retained in the future. The UAA evaluated the "actual" use and the water quality adequate to support the uses. As described in the second paragraph under Section II. *Criteria to Protect the Designated Uses* above, the UAA concluded that contact recreation (wading only) and secondary recreation were existing uses. The proposed site-specific criterion for cadmium of 2 µg/L is not reasonably expected to exceed the narrative criteria for the industrial, contact recreation (wading only), and secondary recreation uses. This expectation considered that the primary Maximum Contaminant Level (MCL) for cadmium is 5 µg/L. Considering the conservative assumptions used in the calculation of an MCL³ the Department finds that the proposed site specific criteria will not pose a hazard from incidental contact or pose hazards from worker contact. It will therefore, protect these existing and designated uses.

II. Aquatic Life Use

Detailed studies were not conducted to document the presence of aquatic invertebrates, macrophytes, or periphyton prior to mining. Limited information is available on benthic invertebrates and fish prior to mine development. Since 1995 studies have been

³ The MCL is calculated based on the assumption of daily consumption of 2 liters of water containing the MCL throughout lifetime of an average human.

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conducted to characterize periphyton and benthic invertebrates. Fish studies have been conducted in the area from 1991 through 2005. A comparison of the aquatic macroinvertebrate and fish communities before and after mine development is summarized in the following paragraphs.⁴

a. Fish

Before mine development, Arctic grayling were rarely seen in Main Stem Red Dog Creek and were not reported in Middle Fork Red Dog Creek (Houghton and Hilgert, 1983). Fish were observed in Main Stem Red Dog Creek within the influence of North Fork (Dames and Moore, 1983) and fish mortalities were documented in Main Stem Red Dog Creek (EVS Consultants Ltd., 1983). Before mine development, Arctic grayling adults were assumed to migrate through Main Stem Red Dog Creek in early spring when discharges were high and metals concentrations low. Outmigration of adults probably occurred during high-water events and young-of-the-year Arctic grayling left as water temperatures cooled in the fall or as they were displaced by high-water events.

After mine development, use of Main Stem Red Dog Creek by Arctic grayling adults and young-of-the-year was higher than that reported during baseline studies in the early 1980s. Stressed or dead fish were not observed. In many cases, adult fish were observed actively feeding on drift and terrestrial insects. Beginning in 1995, juvenile Dolly Varden were caught with minnow traps in Main Stem Red Dog Creek below the North Fork. Juvenile Dolly Varden use of Main Stem has continued to be documented each summer since 1995.

The growth and propagation of fish is an existing use as well as a designated use because fish have occurred in the past and currently use Main Stem Red Dog Creek during the ice free season. Based on the fisheries field work from 1995 through 2005, the fish use of Main Stem Red Dog Creek and Ikalukrok Creek is not diminished compared to the pre-mining fish use.

b. Aquatic Benthic Macroinvertebrates, and
Periphyton

Aquatic invertebrate communities were sampled by EVS and Ott Water Engineers (1983) and Dames and Moore (1983) as part of the baseline studies conducted for Red Dog Creek. Post mining aquatic invertebrate communities were sampled by the Alaska Department of Fish and Game from 1995 through 2005.

⁴ For more information see a report titled: *Comparison of Mainstem Red Dog Creek Pre-Mining and Current Conditions*, Scannell Technical Services, March 1995.

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When compared to baseline studies, aquatic invertebrate densities were lower in station 73 in 1995 than in station 73 or station 8 during baseline studies (Red Dog Use Attainability Analysis Aquatic Life Component, February 1996, pp. 31-34). However, these differences likely reflect the fact that the two studies used different methods to collect invertebrates and because invertebrate taxonomy has changed since the baseline sampling.

The growth and propagation of other aquatic life is an existing use as well as a designated use because aquatic invertebrates and other aquatic life have occurred and currently occur at the site. The lack of aquatic invertebrate, or periphyton field survey data prior to mining preclude making a determination about the quality and biodiversity of these populations prior to mining. Since the pre-mining fish were dependent on these lower trophic levels for survival, it can be assumed that they were present in adequate numbers and diversity to maintain pre-mining fish resources. The 1995 through 2005 post-mining field surveys have firmly established that growth and propagation of aquatic invertebrates, and periphyton are an existing and designated use.

c. Aquatic Life Conclusions

Resident and migratory fish and other aquatic life have acclimated to the natural cadmium concentrations. Current ambient cadmium concentrations are no higher than the pre-mining ambient cadmium concentrations. Therefore, because the cadmium concentrations in the mine's effluent are much lower than the pre-mining natural ambient cadmium concentrations, the growth and propagation of fish existing and designated use will be protected.

ADEC Findings

Based on the information in Attachments A-3 and A-4, ADEC has determined that the baseline water quality is representative of natural conditions in accordance with 18 AAC 70.990(41). The pre-mining water quality data set demonstrates that the natural condition is of lower quality than the applicable cadmium chronic aquatic life criterion. A method for determining the prevailing highest quality natural condition (5th percentile) has been described above and used to develop the site specific criteria: total cadmium concentration of 2 µg/L in Ikalukrok Creek. This site specific criteria is more stringent than the narrative criteria that protect the industrial, contact recreation, and secondary recreation uses and will therefore protect these designated uses. This decision is consistent with the November 5, 1997 EPA policy on establishing site-specific aquatic life criteria equal to natural background, which states in part, "for aquatic life, where the natural background concentration for a specific parameter is documented, by definition that concentration is sufficient to support the level of aquatic life expected to occur naturally at the site absent any interference by humans." Therefore, the growth and propagation of fish, shellfish, other aquatic life, and wildlife use is protected.

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Due to federal Anti-Backsliding regulations the effluent limits for cadmium in future NPDES Permits may be the same regardless of which NCBSSC is used in the calculation. The Department believes that using the cadmium NCBSSC for Ikalukrok Creek sets a precedent that is overly conservative when examining whether downstream uses are protected in setting NCBSSC. We believe that in this case using the NCBSSC for Main Stem Red Dog Creek is appropriate for the following reasons:

- Station 10 is located in Main Stem Red Dog Creek prior to its confluence with Ikalukrok Creek and best represents water quality nearest the effluent outfall where the aquatic life criteria apply.
- The mine facilities have been documented to cause a decrease in cadmium loading to Main Stem Red Dog Creek; therefore, applying the Main Stem Red Dog Creek NCBSSC to the effluent would ensure that the effluent is not contributing to cadmium concentrations above the natural condition downstream in Ikalukrok Creek. Applying the Main Stem Red Dog Creek NCBSSC would therefore protect downstream uses.
- The NCBSSC for Ikalukrok Creek is overly conservative due to the location of Station 8, which the NCBSSC is based on. Station 8 is located in Ikalukrok Creek just below the confluence with Main Stem Red Dog Creek. Station 8 does not represent well mixed water from the two creeks, but rather is located at a point where upstream Ikalukrok Creek water dominates. Since the Upper Ikalukrok Creek is generally of higher water quality than Main Stem Red Dog Creek, samples collected from Station 8 represent higher quality water than the actual mixed water of the two creeks.

The Department's position remains as stated earlier: that calculating NPDES Permit effluent limits based on the Ikalukrok Creek NCBSSC (2 µg/L), would be protective of existing and designated uses and comply with 18 AAC 70. However, the Department believes that this approach is overly conservative and is not required by applicable State of Alaska regulations.

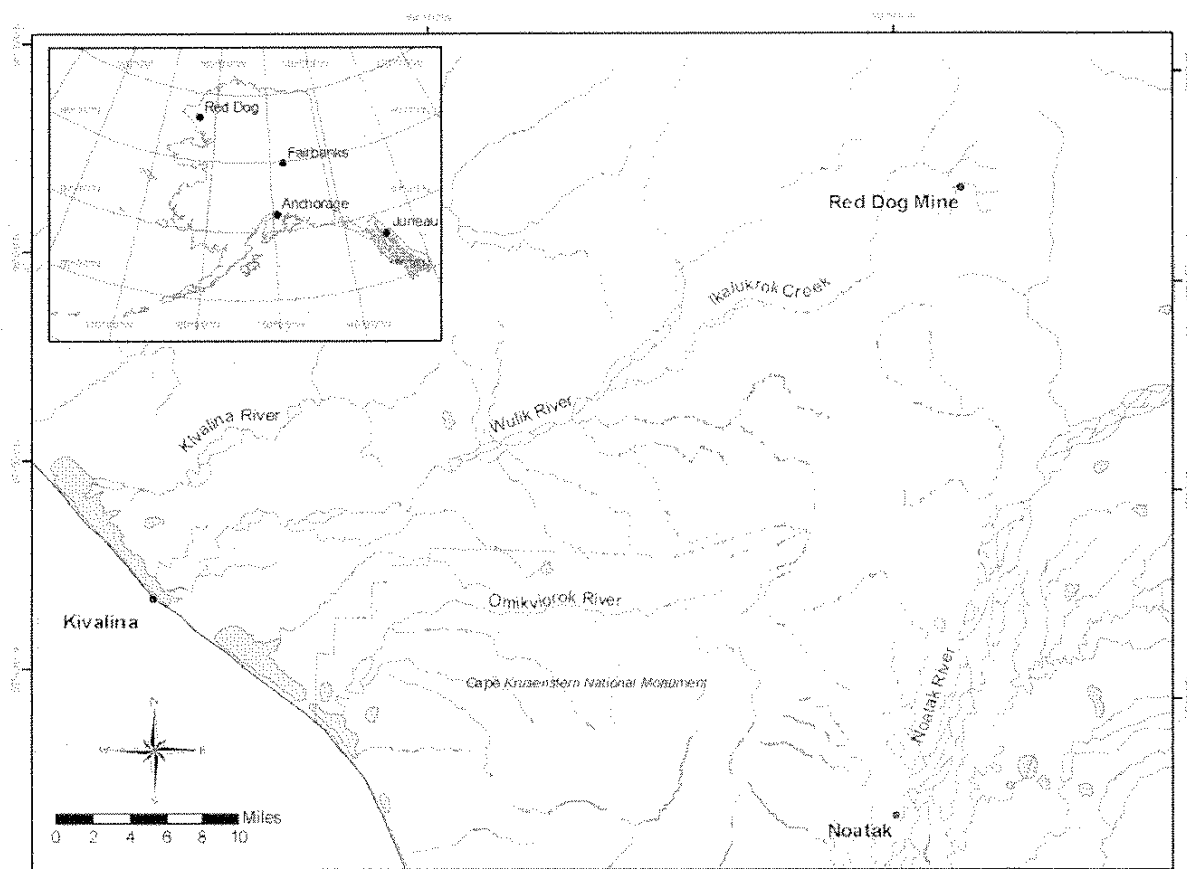
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Attachment A-1

Location of Red Dog Mine Site



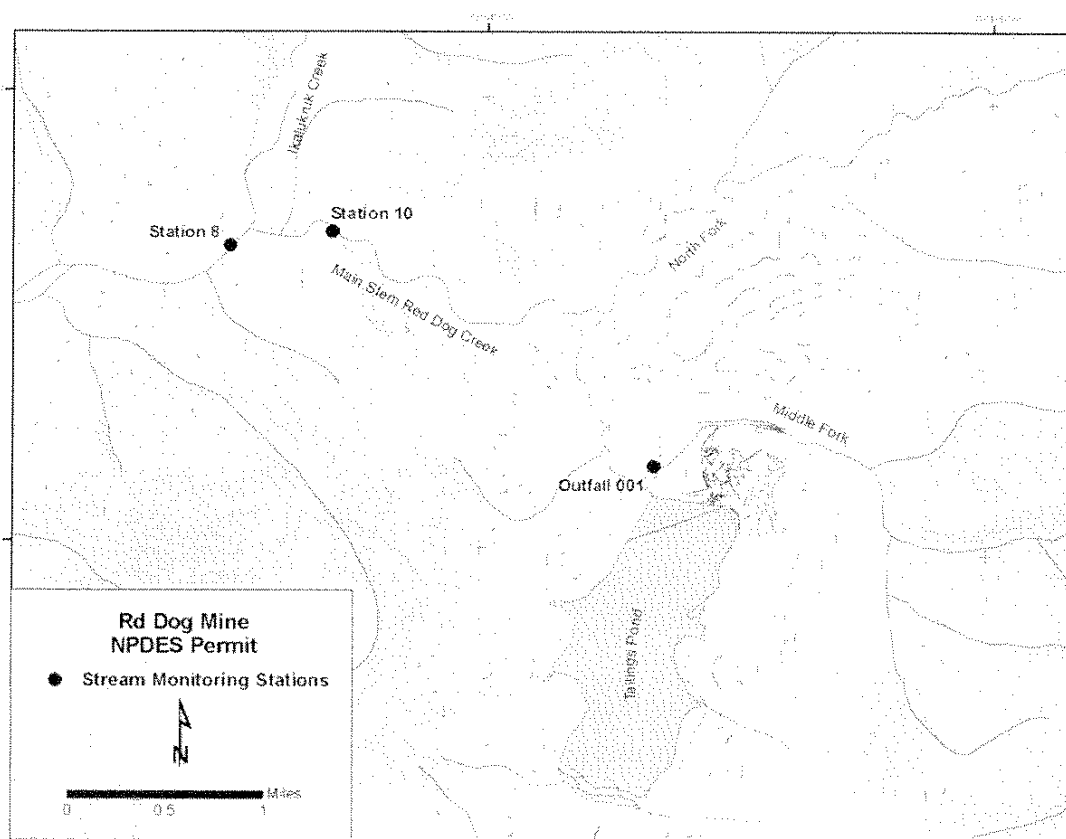
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Attachment A-2

Location of Baseline Monitoring Stations in Mainstem Red Dog Creek and Ikalukrok Creek



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Attachment A-3

Pre-Mining Dissolved Water Quality Data for Cadmium

Date	Station 10 Mainstem Red Dog Creek	Station 8 Ikalukrok Creek below Mainstem Red Dog Creek
6/17/81	22	
7/17/81	25	
7/18/81		10
8/11/81	26	7
9/4/81	38	8
5/30/82	2	
7/6/82	25	
7/8/82	23	14
7/14/82	27	
7/21/82	32	
7/22/82	35	
7/23/82	34	
7/23/82	40	
7/24/82	36	
7/26/82	<25 (12.5)	
7/29/82	27	
7/30/82	<25 (12.5)	
7/31/82	<25 (12.5)	
8/1/82	26	
8/12/82	34	
8/12/82	<25 (12.5)	
8/14/82	17	
9/13/82	34	19
10/19/82	41	34
6/15/83		2

<u>Summary Statistics</u>	Station 10	Station 8
Median	26	9
Maximum	41	34
Minimum	2	2
5 th Percentile	12.5	3.5

* Cadmium data is expressed in micrograms/liter in the dissolved concentration

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Attachment A-4

Pre-Mining Total Water Quality Data for Cadmium

Date	Station 10 Mainstem Red Dog Creek	Station 8 Ikalukrok Creek below Mainstem Red Dog Creek
5/30/1982	2	1
7/6/1982	26	
7/8/1982	24	16
7/14/1982	29	
7/21/1982	31	
7/22/1982	35	
7/23/1982	34	
7/23/1982	38	
7/24/1982	35	
7/26/1982		
7/29/1982	28	
7/30/1982	< 25	
7/31/1982	< 25	
8/1/1982	26	
8/7/1982	36	
8/12/1982	41	25
8/13/1982		
8/14/1982	20	
9/13/1982	38	20
10/19/1982	44	38
5/28/1983	9	4
6/14/1983		
6/15/1983	10	4
7/10/1983	29	7
8/3/1983	33	4
9/3/1983	34	14
6/9/1986		10
6/16/1986		< 2
6/23/1986		< 2
6/30/1986		< 2
7/7/1986		< 2
7/14/1986		10
7/21/1986		< 2
7/28/1986		< 2
6/1/1987		< 2
6/8/1987		4

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6/16/1987		
6/22/1987		7
6/29/1987		8
7/7/1987		9
7/14/1987		< 2
7/20/1987		< 2
7/28/1987		13
8/3/1987		14
8/10/1987		7
8/17/1987		15

Summary Statistics	Station 10	Station 8
Median	29	7
Maximum	44	38
Minimum	2	1
5th percentile	9	2

* Cadmium data is expressed in micrograms/liter in the total concentration.